



ระบบการสอนโดยใช้ดิจิทัลแบคแพคแทนเพิ่มความตั้งใจมุ่งมั่นในการเรียนของนักศึกษาแต่ละคน
ในบรรยากาศการเรียนรู้แบบบรรยาย

A Digital Backchannel Enhanced Instructional System Targeting Agentic Engagement
in Lecture-based Learning Environments

แมทธิว อชา เมอริท¹ อธิปัตย์ คลีสุนทร² และ โลร่า พรหมกสิกร³

Matthew R. Merritt¹ Athipat Cleesuntorn² and Laura Brahmakasikara³

บทคัดย่อ

การวิจัยครั้งนี้ออกแบบศึกษาอิหริพลดิจิทัลแบคแพคแทนเพิ่มความตั้งใจมุ่งมั่นในการเรียนของนักศึกษาที่เรียนจากสภาพแวดล้อมของการบรรยาย มีวัตถุประสงค์เพื่อ 1) หาแนวทางให้นักศึกษาใช้ดิจิทัลแบคแพคแทนเพิ่มความตั้งใจมุ่งมั่นของนักศึกษา 2) ใช้ดิจิทัลแบคแพคแทนเพิ่มความตั้งใจมุ่งมั่นของนักศึกษา 3) ศึกษาลักษณะดิจิทัลแบคแพคแทนเพิ่มความตั้งใจมุ่งมั่นของนักศึกษา 4) ศึกษาผลของระบบการสอนแบบบรรยายที่ใช้ดิจิทัลแบคแพคแทนเพิ่มความตั้งใจมุ่งมั่นของนักศึกษา การวิจัยเป็นแบบปรัชสมวิธี โดยใช้แบบสอบถามเก็บรวบรวมข้อมูลเชิงปริมาณและใช้การวิเคราะห์ปรากฏการณ์เป็นข้อมูลเชิงคุณภาพ ผู้เข้าร่วมการวิจัย ประกอบด้วย นักศึกษาปริญญาตรี มหาวิทยาลัยเอกชนนอกเขตกรุงเทพฯ ประเทศไทย จำนวน 171 คน และคัดเลือกนักศึกษาแบบเจาะจง จำนวน 10 คน เข้าร่วมการสนทนากลุ่ม ผลการวิจัยพบว่า 1) นักศึกษาใช้ดิจิทัลแบคแพคแทนเพลตอบคำถามครุผู้สอนได้โดยสะดวก 2) ดิจิทัลแบคแพคแทนเพิ่มความตั้งใจมุ่งมั่นในสาระที่เรียนมากขึ้น 3) ลักษณะดิจิทัลแบคแพคแทนเพิ่มความตั้งใจมุ่งมั่นของนักศึกษา คือ การแสดงความคิดเห็นที่กระหึ่ม ชัดเจน (ไม่ครอบคลุม) 4) ระบบการสอนแบบบรรยายที่ใช้ดิจิทัลแบคแพคแทนเพิ่มความตั้งใจมุ่งมั่นของนักศึกษาในการเรียนมากขึ้น สำหรับอนาคต ผู้วิจัยสามารถศึกษาอิหริพลดิจิทัลแบคแพคแทนเพิ่มความตั้งใจมุ่งมั่นของนักศึกษาในการเรียนมากขึ้นที่อยู่น้อยกว่าระดับอุดมศึกษา

คำสำคัญ: ความตั้งใจมุ่งมั่นของแต่ละคน, ดิจิ托ลแบคแพคแทน, การเรียนแบบบรรยาย, ระบบการสอน

Article Info: Received 25 June, 2020; Received in revised form 28 August, 2020; Accepted 30 August, 2020

¹ M.Ed., Curriculum & Instruction, Univ. of Washington, USA; M.A. Organization & Leadership, Univ. of San Francisco, USA.
Email: matthewmerritt@yahoo.com

² Ph.D., International Development Education, Florida State University, USA. Email: athipatcls@au.edu

³ Ph.D., Educational Leadership, Assumption University, Thailand Email: lbrahmakasikara@au.edu

Abstract

This research study was designed to examine the influence of a digital backchannel on student agency in a lecture-based learning environment and to develop an instructional system designed to assist instructors in increasing student engagement. The objectives of the study were to determine (1) the ways in which undergraduate students use a digital backchannel, (2) if using a digital backchannel affects agentic engagement, (3) which features of the digital backchannel affect agentic engagement, and (4) if a lecture system that utilizes a digital backchannel promotes agentic engagement. The study employed a mixed methodology design using a questionnaire to collect quantitative student profile data and phenomenography to conduct a qualitative inquiry into participants' experience. The population for this study consisted of undergraduates at a private, International university located outside of Bangkok, Thailand. A total of 171 participants took part in this study, with ten students selected for a focus group through a non-probability, purposive sampling. Overall, the study found that (1) students readily use a digital backchannel to answer questions posed by the instructor, (2) through a digital backchannel, students have the opportunity to agentically engage in course content, (3) the digital backchannel feature of microblogging enhanced agentic engagement, and (4) the strategic use of a digital backchannel as part of a lecturing system can encourage student agentic engagement. Future research in this area could examine how a digital backchannel can increase agentic engagement in younger students.

Keywords: agentic engagement, digital backchannel, lecture-based learning, instructional system

Introduction

An issue facing today's university lecture halls, worldwide, is the universal lack of student engagement, specifically student agency. Agentic engagement is a student-initiated pathway, representing the "students' constructive contribution to the flow of instruction" as they express interests and offer input to their instructor (Reeve & Shin, 2020). For the agentically-engaged learner, their role in lecture-based learning environments is unclear. They seek to take an active role in the classroom, but in an environment where questioning, commenting, and contributing are not coveted, this leaves them isolated and unsure

of expectations. The lecture hall does not promote what Reeve and Shin (2020) describe as the “purposive, proactive, and reciprocal type of engagement” (p. 150) that is integral to promoting student agency.

Lecture-based instruction has a long and revered history in tertiary education. It is an appealing format for instructors and curriculum writers for several reasons. The lecture provides an instructional format that is universal, orderly, predictable, and repeatable. The instructor is central to the learning environment and assumes the influential position of source and presenter of pre-selected information. In the lecture hall, the student's role is often a passive one, with a simple set of expected behaviors, including listening, note-taking, keeping quiet, and staying still, with the end goal of retaining presented materials for a standardized exam. The instructor unilaterally makes decisions, and the scope and timing of content are predetermined. In response to the one-size-fits-all approach inherent with lecture-based instruction, educational technology has historically provided substantial tools to meet the needs of individual learners. The digital backchannel is built on interactivity and provides a tool for learners to ask, exchange, process, and engage with each other, the instructor, and course content on a personal level.

A common misconception of digital backchannel use in lecture-formatted instruction consists of an increase in student distraction. A study conducted by Baron et al. (2016) found that there was little evidence of the backchannel promoting distraction in class. Instead, student distractions are the product of a mismanaged backchannel instead of the backchannel itself. The overall learning environment is enhanced based on the feedback that a digital backchannel can potentially provide. Student questions, comments, and backchannel contributions were continuously monitored throughout this study as the researcher sought to use the backchannel to increase student engagement

and agency.

Thai universities are not immune to the lack of student agency where most teachers still have a dominant transmission and controlling role in classroom learning activities (Tapinta, 2016). Politeness, honor, social conformity, and passivity are all integral parts of Thai culture and are found in the school systems. These cultural norms are embodied by the country's standard practice of undergraduates being required to wear a uniform; a practice followed by very few other countries. Whereas agentic engagement involves questioning, self-empowerment, and active involvement in the flow of instruction, the requiring of uniforms creates passive characteristics and obedience to authority and reinforces the superiority of teachers and inferiority of students (Bunyawanich et al., 2018). Use of a digital backchannel allows for student voice and choice, without asking Thai students to directly confront their cultural norms.

Three learning theories provided the theoretical foundation for this study. A digital backchannel offers opportunities for student to student, student to instructor, and student to content interaction. Interactions of this nature are markers of learning that fall within the learning theory of Social Constructivism. Central to this theory is the notion that knowledge is constructed as a result of collaborative interaction and stimuli. Louvigné et al. (2018), further explained that contemporary learning theories and their implementations associated with information and communication technologies increasingly integrate social constructivist approaches in order to assist and facilitate the construction of knowledge.

When considering student engagement, the Social Cognitive Theory of learning is a common reference. Schunk and Usher (2019) hold the Social Cognitive Theory which emphasizes much of human learning and behavior occur in social contexts. By its nature, a digital backchannel is a social context.

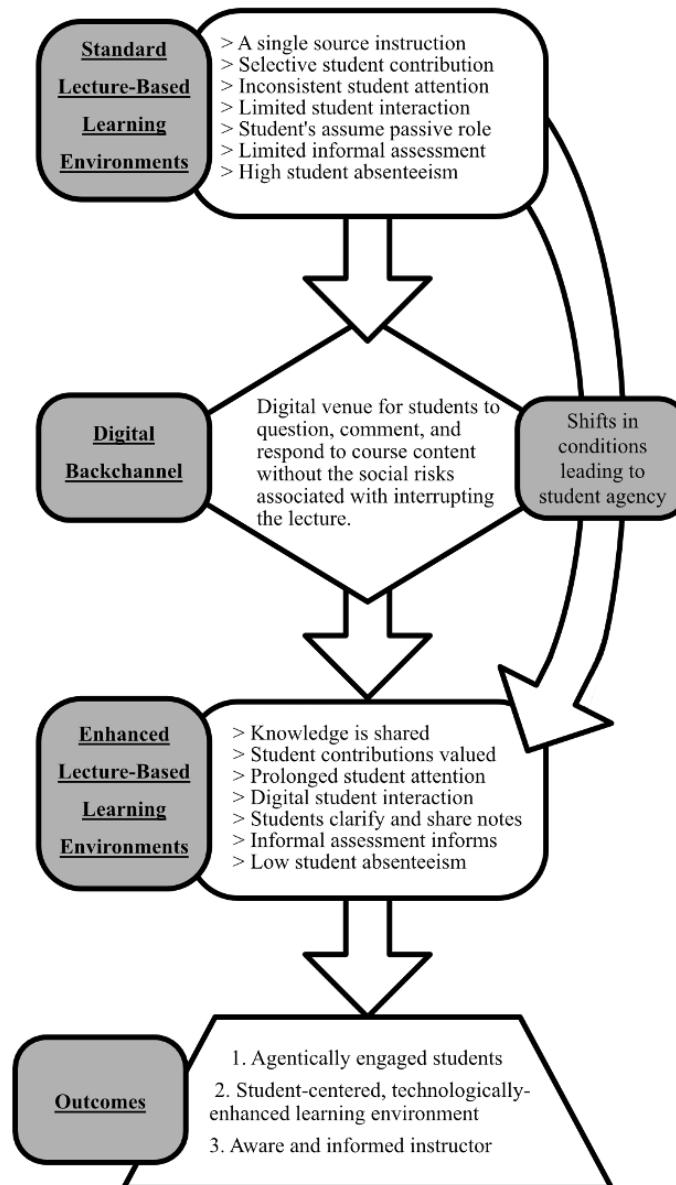
Schunk and Usher's modern take on Social Cognitive Theory maintains that through observation and interaction with others, learners acquire knowledge, skills, strategies, beliefs and attitudes. The increase in socialization through the digital backchannel provided a venue for social learning for participants.

Finally, Connectivism is a learning framework for understanding how information is processed in a technological society. With the Connectivism framework, learning occurs when knowledge is actuated through the process of a learner connecting and feeding information into a learning community. Siemens (2017) stated that the starting point of connectivism is the individual. Personal knowledge is comprised of a network, which feeds into organizations and institutions, which in turn feed back into the network, and then continue to provide learning to individual. This cycle of knowledge development (personal to network to organization) allows learners to remain current in their field through the connections they have formed. The digital backchannel provided the network that lies at the center of Connectivism's learning theory.

Central to the conceptual framework (Figure 1) of this study was the digital backchannel. The digital backchannel employed several features to provide a venue for students to learn and practice aspects of student agency. These features included updating in real-time, providing for a large number of synchronous users, requiring registration information to provide for secure chatrooms, providing the option for users to select their username, allowing for the digital backchannel to project onto a screen in the lecture hall, and the provision for transcription saving and export. These are standard features found in most free online digital backchannel applications.

Figure 1

Conceptual Framework. Shifts in conditions leading to student agency through the use of a digital backchannel.



The specific digital backchannel used for this study was the web-based application called Padlet (Wallwisher Inc., 2017). Within the application, a Padlet is essentially a digital chat room that allowed each of the course's four sections

to have its own dedicated space. Padlets can be saved and exported as portable document formats or pdfs. The program offers many design features that, when utilized, increase interactivity between instructor and student, between students, and between course content and students. For this study, students used their student number as their profile name. This allowed students to operate within the backchannel with a sense of anonymity with the expectation that it would lead to more honest contributions. Each participant had access to the full range of Padlet options. These included posting questions, answers, and comments; commenting and rating other participants' posts; and adding a full range of media, as in sound, photos, video, color, text enhancements, and external links to contributions.

Research Questions

This study was concerned with identifying the ways a digital backchannel can transform the relatively passive experience of a lecture into one where student voice, investment in learning, and active engagement are part of the learning environment.

Questions that led to these targets include:

1. How will students use a digital backchannel in lecture-based courses?
2. How does the use of a digital backchannel influence student agency?
3. What features of a digital backchannel influence student agency?
4. What are the components of an instructional system that supplement a lecture, utilizes a digital backchannel, and increases student agency?

Research Objectives

Through an explorative and comprehensive phenomenographic method, answers to the questions mentioned above led to the development of four

objectives for this study:

1. To find the ways in which undergraduate students use a digital backchannel.
2. To establish a relationship between the use of digital backchannel and student agency.
3. To classify the features of a digital backchannel that influence student agency.
4. To create a digital backchannel-based lecturing system that supplements the traditional lecture and increases student agency.

Methodology

This study was conducted from January to May 2018, at a private, International university outside of Bangkok, Thailand. The population for this study was undergraduates enrolled in a lecture-based course, Environmental Science, GE1301. Participants consisted of four sections of the course meeting three hours per week for 15 weeks and ranged in age from 18 to 23 years old. Of the 171 participants, 97 were female and 74 were male. 140 considered Thailand as their home country, 27 identified as Chinese, and four were from other countries. The course was taught in a standard lecture-based learning environment, with a large number of students in a single classroom, set up in one-directional, theatre-style seating arrangement.

A mixed method research design was utilized in this study. The quantitative component of this study included a pre-treatment questionnaire adapted from Jang and Reeve's 2016 Agentic Engagement Scale. The purpose of the questionnaire was to establish an agency profile for each participant that would inform a heterogeneous, representative group to participate in the focus group. The focus group was a representative group designed to provide a wide

range of students who had historically engaged in their lecture-based classes at varying degrees. Agentic engagement from a wide range was desirable as a way to determine if the lecture system influenced participants differently based on their predisposition to agentic engagement.

The qualitative component of the study provided the majority of data collected over the course of the 15-week study. The phenomenographic method employed in this study was used to describe the ways in which participants experienced the common phenomenon of using a digital backchannel in a lecture-based learning environment. The analysis involved a holistic examination of the participants' actions and feelings regarding the use of a digital backchannel. Phenomenographic analysis was completed on the digital backchannel entries, field notes, and focus group transcription. Each data source provided a different perspective on the experience and all contributed to structural descriptions of each participant's experience. The web-based program, HyperREASEARCH, was used to record and organize codes and themes.

The phenomenography yielded the systematic reduction of text-based data or bracketing into themes and codes that led to each participant's structural descriptions. Bracketing helps the researcher develop a keen awareness of participant's assumptions and expectations (Sohn et al., 2017). Analysis consisted of multiple readings of the text, the identification of patterns and repetitions within the text, and the construction of meaningful units. The researcher was able to consider the digital backchannel experience from the perspective of the participant and gain a deeper understanding of how technology influenced learning. Features of the technology were isolated and discussed in detail, providing insights into how and why specific features were used and preferred over others.

The development of the Digital Backchannel-Enhanced Instructional

System (DBEIS) was based on the Seven-Step Model for Prototype Development designed by Brahmawong in 1999 (Raso et al., 2018) The procedure was designed to develop and test the digital backchannel-enhanced instructional system comprehensively. The conceptual model was sent to five experts in the field to help establish the validity of the methodology and provide feedback that was incorporated into the design of the instructional system.

Both quantitative instruments and qualitative procedures associated with each data source were sent to the same five field experts to establish data validity and trustworthiness. First, the questionnaire was presented to the five field experts for any suggestions for improvement. Next, items in the questionnaire were corrected and adjusted in accordance with comments and recommendations made by the experts. Next, after receiving feedback and recommendations, the researcher used the Index of Item-Objective Congruence (IOC) to find the content validity. The experts evaluated the ten items of the questionnaire based on the score range from -1 to +1, where items that were congruent scored a +1, items that were questionable were scored with a 0, and incongruent items were scored -1. Items that received total scores lower than 0.5 were revised. Conversely, the items that had scores higher than or equal to 0.5 were reserved. Six items were related to agentic engagement behaviors and scored an index average of 0.82. All items were reserved. The remaining four items related to agentic disengagement behaviors and averaged a score index of 0.7. All of these items were also reserved. The same experts also provided feedback on the focus group questions and phenomenographic procedures for collection and analysis of qualitative data.

Research Results

Table 1 shows a selection portion of the results of the quantitative data

analyzed as the measure for the purposive selection sampling for focus group participation.

Table 1

Focus Group Participants Agentic Engagement Questionnaire Results

#	Name	Tech. Use*	Spoken English*	Written English*	Agentic Engage*	Agentic Disen- gage*	Profile
1	Alan	7	7	7	6.3	3.3	Confident in both technology and English use. Highly engaged, low disengagement.
2	Bill	7	6	4	6.2	3.0	Confident technology user. Highly engaged, low disengagement.
3	Andy	7	4	4	5.0	3.25	Confident technology user. Average engagement, low disengagement.
4	Prim	4	5	5	3.0	3.0	Not confident user of technology or English. Low engagement and disengagement.

Table 1 (Cont.)

Focus Group Participants Agentic Engagement Questionnaire Results

#	Name	Tech. Use*	Spoken English*	Written English*	Agentic Engage*	Agentic Disen- gage*	Profile
5	Charlie	7	3	3	4.8	4.5	Confident technology user. Limited English use. Low engagement, high disengagement.
6	Polly	6	7	7	6.7	2.3	Confident technology and English user. Highly engaged, low disengagement.
7	Molly	4	5	6	6.3	4.5	Not confident technology user. Highly engaged and disengaged.
8	Carly	3	3	6	4.5	2.0	Not confident technology user. Low disengagement.

Table 1 (Cont.)

Focus Group Participants Agentic Engagement Questionnaire Results

#	Name	Tech. Use*	Spoken English*	Written English*	Agentic Engage*	Agentic Disen- gage*	Profile
9	Philip	7	4	3	6.2	2.5	Confident technology user. Highly engaged, low disengagement.
10	Frank	6	5	5	6.2	5.3	Confident technology user. Highly engaged and disengaged.
	Study AVG	5.9	4.6	4.8	5.0	3.8	

Note. Study average is based on 171 participants.

* The research instrument was a seven-point, Likert scale questionnaire asking each participant to self-assess themselves on pre-treatment levels.

RQ1: How will students use a digital backchannel in lecture-based courses? Phenomenographic analysis showed an increase in student participation through the backchannel, and this participation increased when the students knew the backchannel was being monitored and the instructor was providing feedback. The initial analysis of the entries resulted in several generalizations. First, the sheer number of entries was worth noting. At over 2,000 entries throughout the study, on average, this constituted 26 backchannel entries per hour, per section. When compared to the average face-to-face participation rate of eight contributions per hour, the backchannel, as a learning tool, was well-utilized and provided participants with an avenue not typically provided for in a standard lecture hall.

RQ2: How does the use of a digital backchannel influence student agency?

The use of personal technology has been shown to increase participation in lecture-based learning environments, and findings as a result of this research study support these conclusions. This study concluded that specific aspects of student agency (intentionality and self-awareness) were utilized in the backchannel more than others (forethought) and to find an increase in the development of these specific aspects of agentic engagement would require further study.

RQ3: What features of a digital backchannel influenced student agency?

The study concluded that microblogging was the backchannel feature that led to the instances of agentic engagement. This was due to the participant's ability to express their thoughts, needs, and wants, in the short text-based entries. Analysis also led to the conclusion that participants who showed a tendency towards agentic engagement before the study were more likely to use the digital backchannel in agentic ways during the study. Contributions to the backchannel from focus group participants did not relate directly to the amount participants contributed to the focus group discussion. This discrepancy is an indication of the backchannel's appeal to those students who are less comfortable verbally conversing in English.

RQ4: What are the components of an instructional system that supplements a lecture, utilizes a digital backchannel, and increases student agency? During focus group meetings, six components of The Digital Backchannel Enhanced Instructional System (DBEIS) were discussed: grounding, instruction, question & comment, monitoring, reflection, and preparation. Equally important as the components was the lecturer's philosophy regarding student agency. The system allowed for opportunities to practice agentic engagement, but the system required a lecturer who believed in the value of student agency and

promoted students to engage with each other and the course material. Both structure and user were needed for the system to be effective.

Table 2 provides examples for each of the focus group participants of phenomenographic analysis and the formation of structural descriptions. These descriptions, along with the process of bracketing led to the answers to the research questions.

Table 2

Structural Description Formation

#	Name	Observations, Quotes, Notes	Structural Description Excerpt
1	Alan	“Padlet was really easy to use and find some information from others. I could add my ideas to the lecture.”	Alan’s sense of efficacy is strong and when he used Padlet, he was one of the few students who provided feedback to the instructor regarding the pace of speaking or content presented.
2	Bill	Most of participant’s backchannel contributions added in between classes.	Bill uses Padlet when prompted and of his own accord, as it “provides him time to think about the right words” and produce reflective responses.
3	Andy	Participant is quiet and rarely contributes to verbal discussions.	It was difficult to tell from Andy’s demeanor how much or little he was understanding during lectures.

Table 2 (Cont.)

Structural Description Formation

#	Name	Observations, Quotes, Notes	Structural Description Excerpt
4	Prim	“Padlet helps me to know how others answered the question. It gives me time to work out the vocabulary.”	Prim is a quiet student in her second year at university. She is observant, but passive in class. She rarely used technology to help her learn and relies upon her friends when asked to timely contribute to discussions.
5	Charlie	Participant often uses phone to translate English into Thai during lectures.	Charlie described his lecture experience as a “challenge. My challenge is to understand the words which might be quite difficult, so I was better to learn the reading before I get into class.”
6	Polly	“Teachers asks us to do more group work, so most of our work we could do together on the backchannel.”	Polly was a prolific contributor during class discussions and although she is confident in her use of technology in an educational setting, she preferred discussing environmental issues face to face.
7	Molly	“I think most students are distracted by their phone.”	Molly prefers to work with her peers and instructor rather than use technology when learning a new concept.

Table 2 (Cont.)

Structural Description Formation

#	Name	Observations, Quotes, Notes	Structural Description Excerpt
8	Carly	Participant is often engaged, but not agentically, allowing concepts to pass her by without seeking understanding.	Carly felt much more comfortable reading and writing English than speaking it and appreciated how the Padlet was available to her after class. She was an attentive student, but did not regularly contribute to the backchannel, choosing to read and reflect on what others had to say on a topic.
9	Philip	Participant commonly reacts to other's backchannel contributions with his own stories and experiences.	Philip enjoys using technology in and out of class. He is not shy about the fact that it can distract him from his studies.
10	Frank	Participant is able to comprehend English at a higher level than his ability to produce it. He uses phone to translate.	Franks admits to being easily distracted during long lectures and would often open a second window on his device and check his other social media sites to fill the time.

Note. Observations, field notes, and transcriptions led to the formation of themes and the construction of the structural descriptions for each participant.

Discussion

The backchannel entries and focus group discussion transcriptions provided the researcher with an abundance of direct source data. The initial analysis of the entries resulted in several generalizations. First, the backchannel was well-used and provided participants with a voice. The backchannel feature of microblogging or “fast open real-time communication using short messages between users” (Hronmic & Hayes, 2020), was the most utilized backchannel feature and provided a venue for participants to agentically engage in course content. Considering Thai students are raised to respect their teachers and minimize interaction and questioning in class, higher rates of participation in discussions is a meaningful result. Backchannel entries were almost entirely used for course-related contributions, and there were very few entries of off-topic dialogue and socialization as anticipated by the researcher.

When the backchannel was monitored, students used it more often. Previous research in this area supports the concept that if feedback is timely, specific, and relevant, there are positive effects on student learning (Brooks et al., 2019). Feedback, as described by Brooks et al., was consistent with the findings of this study where students participated with more frequency and with more course-related comments and questions if they knew the entry was going to be monitored and potentially elicit a response.

Agency in the backchannel translated to agentic engagement in person. Students that showed a high level of engagement, including agency, undertook similar behaviors when in learning situations, both online and in person. These habits included providing personal opinions, engaging in respectful discourse, engaging the learning community, using a variety of resources, and interacting with a mentor (Preus et al., 2016). The digital backchannel gave Thai students an opportunity to agentically engage in ways that do not directly oppose cultural

norms. Similar to their non-Thai counterparts, participants that displayed agentic engagement before the study were more likely to use the digital backchannel to agentically engage during the study.

Conclusions, Implications, Recommendations

The backchannel was popular with the participants as a way to participate in the course. With over 2,000 backchannel entries by the 171 participants over 15 weeks showed that the use of personal technology in lecture-based learning environments can increase participation. To further elicit this point, participants that did not contribute readily to the focus group discussion were more productive within the digital backchannel. Despite the focus group engaged in an unbalanced discussion, the backchannel, itself, was composed of a wide range of contributors. A discrepancy in participation in the digital world versus the real world can be an indication of the backchannel's appeal to those students who are less comfortable conversing in English in real-time.

The instructional system helped the lecturer stay focused on learner-centered instruction. By employing the DBCIS framework, the instructor was able to engage in systematic formative assessment, provide real-time feedback, and build natural breaks in the flow of the lecture. Within the cultural context of Thailand, student agency is not recognized as a valued aspect of engagement. However, Reeve and Shin (2020) have identified agentic engagement as an independent predictor of student achievement, worthy of development in all learning environments. Considering the prevalence of lecture-based learning environments in Thailand, technology can provide a means to allow students to benefit from agentic engagement without confronting established cultural norms.

It is recommended that further study consider the application of a digital

backchannel-enhanced instructional system with upper secondary students. Giving these students the opportunity to increase their agentic engagement before university-level studies may have a positive effect on how these students learn in lecture-based learning environments. Agentic engagement may be a learned skill that could benefit learners from an earlier age and adjust how these learners perceive their role in their own education.

Limitations

There are a number of limitations that should be factored into the analysis of this study, namely, the study took place at a private, International university in Thailand. The conclusions reached as a result of the data collected in this study will consider the cultural and social context but may not represent a typical Thai population. Another limitation of this research is that it took place amongst students enrolled in a single subject area. Environmental Science is a lecture-based course and is part of the general education requirements for a bachelor's degree in the Faculty of Arts. For conclusions to be drawn across a larger population of undergraduates, other courses in additional faculties should be considered.

References

Baron, D., Bestbier, A., Case, J. M., & Collier-Reed, B. I. (2016). Investigating the effects of a backchannel on university classroom interactions: A mixed-method case study. *Computers & Education*, 94, 61-76.

Buasawan, P. (2018). *Rethinking Thai higher education for Thailand 4.0*. Asian Education and Development Studies.

Bunyawanich, S., Järvelä, M. L., & Ghaffar, A. (2018). The influence of uniform in establishing unity, hierarchy, and conformity at Thai universities. *Journal of Education and Training Studies*, 6(7), 28-37.

Brooks, C., Huang, Y., Hattie, J., Carroll, A., & Burton, R. (2019). What is my next step? School students' perceptions of feedback. In *Frontiers in Education* (Vol. 4, p. 96). Frontiers.

Hromic, H., & Hayes, C. (2018, August). Characterising and evaluating online communities from live microblogging user interactions. In *2018 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining (ASONAM)* (pp. 21-24). IEEE.

Jang, H., Kim, E. J., & Reeve, J. (2016). Why students become more engaged or more disengaged during the semester: A self-determination theory dual-process model. *Learning and Instruction*, 43, 27-38.

Louvigné, S., Uto, M., Kato, Y., & Ishii, T. (2018). Social constructivist approach of motivation: Social media messages recommendation system. *Behaviormetrika*, 45(1), 133-155.

Preus, B., Payne, R., Wick, C., & Glomski, E. (2016). Listening to the voices of civically engaged high school students. *The High School Journal*, 100(1), 66-84.

Raso, D., Aiempaya, K., Noymantee, N., & Anukulwech, A. (2018). Computer Multimedia Assisted Presentation Program Teaching Courseware. *SAR Journal*, 1(3), 71-76.

Reeve, J., & Shin, S. H. (2020). How teachers can support students' agentic engagement. *Theory Into Practice*, 59(2), 150-161.

Schunk, D. H., & Usher, E. L. (2019). Social cognitive theory and motivation. In R. M. Ryan (Ed.), *The Oxford handbook of human motivation* (pp.11-26). Oxford University Press.

Siemens, G. (2017). *Connectivism. Foundations of Learning and Instructional Design Technology*.

Sohn, B. K., Thomas, S. P., Greenberg, K. H., & Pollio, H. R. (2017). Hearing the voices of students and teachers: A phenomenological approach to educational research. *Qualitative Research in Education*, 6(2), 121-148.

Tapinta, P. (2016). Thai teachers' beliefs in developing learner autonomy: L2 education in Thai universities. In B. Roger & L. Jinrui (Eds.), *Language learner autonomy: Teachers' beliefs and practices in Asian contexts* (pp. 96-113). IDP Education (Cambodia).

Wallwisher Inc. (2017). *Padlet (Version 114.0)* [Mobile app]. Padlet. <https://padlet.com/>